Vol. XXIV. Part III. SEPTEMBER, 1953.

COMMONWEALTH INST. ENTOMOLOGY LIBRARY
13 NOV 1953
SERIAL As/94A
SEPARATE

THE

TEA QUARTERLY

THE JOURNAL

OF THE

TEA RESEARCH INSTITUTE

OF CEYLON

THE TEA RESEARCH INSTITUTE,
St. Coombs, Talawakelle,
Ceylon.

NOTICES

General.—The laboratories of the Institute are situated at St. Coombs Estate, Talawakelle, and all letters and enquiries should be addressed to the Director, Tea Research Institute, Talawakelle. Telegraphic address : RESEARCH, TALAWAKELLE, Telephone : Talawakelle 44 (Private Exchange).

It is particularly requested that letters should not be addressed to officers by name. Specimens and other consignments sent by rail should be forwarded to Talawakelle Station, C/o Messrs. M. Y. Hemachandra & Co. Ltd. Forwarding Agents. *Carriage should be pre-paid.*

Visitors' Days.—The *second* and *last* Wednesdays in each month have been set aside for Visitors' Days at St. Coombs Estate and also at the T.R.I. Sub-Station, Gonakelle Estate, Passara, when it is hoped anyone interested will visit the stations.

Guest House Rules.— (1) The St. Coombs Guest House is normally intended for persons visiting the Institute and St. Coombs Estate on business. Children can in no circumstances be accommodated.

(2) Permission to occupy a room for the night must be obtained from the Director in writing and, unless sufficient notice be given, accommodation cannot be guaranteed.

(3) All visitors must sign the Visitors' Book on arrival.

(4) A bedroom may not be occupied for more than one night if required by another visitor. This shall not apply to members of the Board or of Committees meeting at St. Coombs who shall also be entitled to priority in the allocation of accommodation when on official business.

(5) Complaints or suggestions shall be entered in the book provided for the purpose and not made to the Guest House Staff.

All payments due for services rendered shall be made in *cash* to the Guest House Keeper and a receipt obtained from him on the official form. The scale of approved charges is posted in the building. The Guest House keeper is forbidden to give credit or to accept cheques.

(6) All breakages will be charged for at cost price.

Publications.—The *Tea Quarterly* and *Bulletin* published by the Tea Research Institute will be sent free of charge, to Superintendents of Ceylon tea estates, over 10 acres in extent, and to estate Agencies dealing with Ceylon tea, if they register their names with the Director, Tea Research Institute of Ceylon, St. Coombs, Talawakelle.

Other persons can obtain the publications of the Institute on application to the Director, the subscription being Rupees fifteen per annum for persons resident in Ceylon or India, and £ 1–5–0 for those resident elsewhere. Single members of *The Tea Quarterly* can be obtained for Rs. 2–50 or 4*s*. In the case of Indian cheques four annas should be added to cover commission.

BOARD OF CONTROL

of the

TEA RESEARCH INSTITUTE OF CEYLON

Chairman

Mr. R. C. Scott, C.B.E.

Secretary

Mr. J. Lamb, J.P.

Appointed by the Planters' Association of Ceylon:—

Mr. R. C. Scott, C.B.E.
Mr. B. C. V. Weeks.
Mr. H. S. Hurst.

Appointed by the Agency Section, Planters' Association of Ceylon:—

Mr. G. K. Newton.
Mr. A. D. McLeod.
Mr. W. H. Attfield.

Appointed by the Low Country Products' Association:—

Mr. W. Neal de Alwis, M.P.
Mr. Errol Jayawickrema, J.P.,U.M.
Mr. D. E. Hettiarachchi, J.P.,U.M.

Representing the Small Holders:—

Mr. V. G. W. Ratnayake, M.B.E., M.P.

Ex-Officio Members:—

The Hon. The Minister of Finance.
The Director of Agriculture.
The Chairman, Planters' Association of Ceylon.
The Chairman, Agency Section, Planters' Association of Ceylon.

STAFF

DIRECTOR	... J. Lamb, M.Sc., (Lond.) F.R.I.C., A.I.C.T.A.
DEPUTY-DIRECTOR	... G. B. Portsmouth, B.Sc., (Lond.) A.R.C.S., D.I.C.
Chemical Division.	
Biochemist	... J. Lamb, M.Sc., (Lond.) F.R.I.C., A.I.C.T.A.
Agricultural Chemist	... J. A. H. Tolhurst, B.Sc., (Reading)
Technologist	... E. L. Keegel.
Research Assistant	... M. S. Ramaswamy, B.Sc., (Mysore), A.R.I.C., A.I.I.Sc.
Assistants	... E. N. Perera, V. Mendis & S. M. Gunaratnam.

Plant Physiology Department		
Plant Physiologist	...	G. B. Portsmouth, B.Sc., (Lond.), A.R.C.S., D.I.C.
Research Assistant	...	F. H. Kehl
Assistants	...	M. Piyasena E. S. Rajiah & D. H. de Saram.
Pathology Department	...	
Pathologist	...	C. A. Loos, F.L.S., M.I. Biol.
Mycologist	...	B. N. Webster, M.A., (Cantab.) M.Sc., (Nottm.), M.I. Biol.
Assistant Pathologist	...	G. D. Austin
Assistant	...	D. J. W. Ranaweera.
Technical Assistant	...	H. L. Munasinghe.
Field Assistant	...	M. K. Vytilingam & S. Murugiah.
Engineering Department		
Engineer	...	J. Landreth, A.M.I.B.A.E., Member A.S.A.E.
Works Clerk	...	R. A. Daniel.
Electrician	...	W. R. Solomon.
Mechanic	...	D. A. S. Opatha.
St. Coombs Estate		
Superintendent	...	E. S. Rose.
Visiting Agent	...	G. K. Newton.
Tea Maker	...	A. T. Fernando.
Field Assistant	...	B. Asirvadem.
Head Clerk	...	P. E. de Silva.
Assistant Clerk	...	G. L. A. Thomas.
Low Country Sub-Station		
Scientific Officer	...	T. E. Walter, B.Sc., (Edin.)
Assistant	...	F. P. Jayawardena.
Administration		
Secretary	...	G. A. D. Kehl.
Secretary to the Director	...	A. C. Perera.
Asst. Secretary/Librarian	...	G. Mason, B.A., (Lond.)
Accounts Clerk	...	A. H. B. Dias.
Stenographers	...	F. G. de Sielvie & M. Neydorff.
Assistant Clerks	...	K. A. Salaam & F. N. C. de Silva.
Small Holdings Advisory Service		
Officer-in-Charge	...	R. L. Illankoon
Tea Small Holdings Officers	...	W. T. Fonseka, K. P. Abeywickrema, M. V. de Silva & K. de A. Kulasekera.
Clerk	...	N. H. H. Liyanage.
Tea Instructors		
Balangoda	...	D. J. Kulatunge.
Kadugannawa	...	A. Perera.
Karawanella	...	C. E. Sooriaratchchi.
Katugastota	...	P. T. Navaratne.
Katugastota	...	T. B. Ratnayake.
Nawalapitiya	...	B. Weeratunge.
Wattegama	...	D. Nillegoda.
Welimada	...	G. A. de Silva.
Talgampola	...	S. Abeywickreme.
Urubokka	...	G. A. Mendis.

THE TEA QUARTERLY

VOLUME XXIV SEPTEMBER, 1953 PART III

R. G. COOMBE

The passing of R. G. Coombe has removed from the scene of Ceylon tea planting another link with its pioneering days. He was one of those to whose vision the T. R. I. owes its existence. Almost thirty years ago he tabled before the Committee of the Planter's Association proposals for the foundation of a tea research institute. It was a fitting tribute, therefore, that in 1927 he should have been elected Chairman of the Institute's Board of Control on the retirement of Major J. W. Oldfield, under whose Chairmanship, the T. R. I. had been successfully launched in 1925.

The late Mr. Coombe came out to Ceylon in 1891, at the age of 16 to start life as a creeper on Poonagalla under James Bisset. After his period of training, he was appointed Assistant Superintendent of Poonagalla. He gave up this appointment in 1897 to become Superintendent of Chryslers Farm at Kotagala, only to return to Poonagalla in 1899 as Manager, following Mr. Bisset's death. This position he held until his retirement in 1939. While his agricultural interests extended to coffee and rubber, it was as a tea planter that he spent the greater part of his life.

Bob Coombe–as he was known to his friends–belonged to an age in which it fell to the planter to fill a more immediate role in the affairs of this country than is the case today. In 1934, he was nominated a member of the State Council. He was a member of the now disbanded Ceylon Mounted Rifles, and retired as second in command of that regiment. A keen sportsman, Bob Coombe was one of the band of enthusiasts who brought into being the Ceylon Lawn Tennis Association. He was elected a life member of the Planters' Association of Ceylon, having been among its best known personalities during his days of active planting.

At the Tenth Biennial Conference of the Tea Research Institute held this year at Nuwara Eliya, Sir Oliver Goonetilleke, the Minister of Agriculture made reference to Coombe's contribution to the tea industry in Ceylon. It was under his Chairmanship that the Board acquired St. Coombs and laid the foundations of the present station. Previously, the headquarters of the Tea Research Institute had been housed in an old wooden bungalow at Nuwara Eliya. Happily, Coombe had lived to see the Institute firmly organised and strongly established in the confidence of the country.

To the members of his family we extend our sincerest sympathy.

REPORT ON THE POSSIBILITIES OF MECHANIZING TEA CULTIVATION IN CEYLON

S. J. Wright

This report is the outcome of an invitation, under the Colombo Plan, to pay a short visit to Ceylon to examine the possibility of mechanizing tea cultivation, with particular reference to replanting. I arrived in the Island on February 10th and proceeded almost immediately to the Tea Research Institute at Talawakelle. From there I paid visits of varying duration to fourteen estates on both sides of the island; while at the Tea Research Institute Conference at Nuwara Eliya on March 6th and 7th, and on other occasions, I had opportunities of meeting, and talking with, a much greater number of planters. I am most grateful, to the Director and Staff of the Tea Research Institute; to the Superintendents of the estates that were visited; and to many others in the tea industry, for the help and encouragement they so readily gave. From the outset it was clear that this enquiry could only be a preliminary one; that specific recommendations could hardly be made on the basis of only a few weeks' experience. The purpose was rather to consider whether the potentialities of mechanization were promising enough to warrant further enquiry and experiment; and to indicate some lines that further enquiry might follow.

General Observations on Mechanization

Ceylon tea uses more labour than any other large-scale crop in the world. The number of workers on a tea estate is at least 20 times as great as on a U.K. farm of the same size growing crops with a high labour requirement, like sugar beet or potatoes, yet the value of production per acre is not much greater. But the lower labour requirement of Western farming is not so much the result of mechanization in its modern sense of tractors and combine-harvesters, as of much earlier developments like that of the reaping machine in the early 19th century. In most Western farming it is more than 100 years since primary crops like grain or hay were harvested, and far longer since any general cultivation was done by hand. By contrast everything in a field of tea is still done either literally by hand, or with hand-wielded tools.

It is also worth noting that most early developments in mechanization were brought to practical fruition as the result of acute labour shortage; as, for example, when the prairies had to be opened up by the unaided efforts of the first pioneers and their families. But in Ceylon tea there is no general shortage of labour; while if during peak work periods there are occasions of temporary shortage, these only accentuate the fact that at other seasons surplus labour may have to be employed unremuneratively. Here, the reasons for considering mechanization are economic ones in the purely financial sense. On the one hand, the general urge towards higher wages and better living conditions on the part of a very large labour population has brought about a sharp, and still continuing, rise in the cost of producing tea. On the other hand, in the main consuming countries—where the same rising curve of wage rates and purchasing power is almost certainly nearer its peak—the price of tea is rising to the point at which what has hitherto been every man's beverage may become a luxury. If mechanization is to be worth while, it must aim at making it possible for tea to be produced with a substantially lower labour requirement all round.

In the writer's view this means that attention should mainly be concentrated in one or both of two directions—on the jobs with a high labour requirement which go on all the year round, on the peak labour seasons which, if they exist, will determine the size of the labour register. With this in mind, an analysis of present labour use on some typical estates is given later in this report. But, even without such analysis, it seems obvious that mechanization will not be fully effective unless it can be extended actually into the tea field itself.

Difficulties of Mechanizing Field Operations

One obvious difficulty in the way of mechanizing field operations is the nature of the terrain; the steep and rocky slopes that are so regular a feature of tea estates. But a still more general one lies in the present arrangement of the tea bushes themselves, and the virtual impossibility of manoeuvring any mechanically propelled appliance between and around them. Because of this, even where there are no steep slopes or rocks, immediate field mechanization is likely to be practicable only at the level of the appliance which is carried, together with the engine that drives it, on the labourer's back. Appliances of this kind are already being used experimentally for both mechanical plucking and spraying; but what they can accomplish in labour saving is limited,while it is doubtful whether the principle can be applied as effectively to other essential work.

More effective field mechanization will almost certainly depend on getting some kind of mechanically-propelled power unit into the tea field. This may be some kind of tractor pulling or carrying its own implements, or it may be no more than a means of providing a larger and more robust source of power than the labourer can carry on his back. But the use of any such appliance will of necessity be bound up with the introduction of a more appropriate bush pattern—*i.e.* one which gives room for a small tractor or something of the kind to manoeuvre—as and when tea is replanted, or new areas are opened.

Replanting with high yielding clones is already being seriously considered as a means of higher production, and on several estates newly planted areas are to be seen at all stages up to bushes just in production. But in every case the replanting has been done in a manner which is likely—because the rows are too close together with no provision for turning at the ends—to prohibit mechanization for another 50 years. If, therefore, the wider possibilities of mechanization are to be seriously considered—and it may be said immediately that, in the light of subsequent discussions, there is a case for doing so to be made out—then the institution of experimental work to determine the most suitable replanting pattern is a matter of urgency.

It is understood that by Government Ordinance all replanting will be done on the contour. This will tend to reduce the difficulties arising from steep slopes, as well as from open field drains, although, here again, experimental work on arrangement will need to be done.

Present Labour Utilization

The following analysis is based on detailed information from five estates, only three of which were actually visited. The sample is obviously not large enough to be conclusive and if the subject of mechanization is to be given more detailed consideration in the future, a corresponding analysis for a much greater number of estates ought to be undertaken. At the same time, the figures relating to these five estates—which varied quite widely in area and situation—were so remarkably consistent, at least as regards main items, that they provide a satisfactory enough basis for present discussion.

The analysis includes all labour other than supervisory and office staff. Of the individual items listed; "Maintenance" includes all work on roads, paths, drains, terracing, ravines and boundaries; "Bush Sanitation" includes all the work of mossing, ferning and root growths incidental to pruning; "Factory" includes red leaf picking, which may amount to as much as half the total factory labour employed; "Services" includes all the labour concerned in scavenging, general health and welfare services, etc. The final column—labour cost in cents per pound of tea—has been calculated by assuming an average daily wage of 2.05 rupees, with an average yield of 800 pounds per acre, and is included only to enable comparison to be made with estimates from other estates.

Analysis of labour use on five estates

	Labour days as % of total	Labour days per acre	Labour Costs Cents/lb.
Plucking	44.4	127.6	32.8
Weeding	18.7	53.7	13.7
Forking & Manuring	4.3	12.3	3.2
Dusting & Spraying	3.6	10.3	2.6
Bush Sanitation	3.1	8.9	2.3
Green Manure	2.4	6.9	1.8
Pruning	1.9	5.5	1.4
Maintenance	6.4	18.3	4.7
(Total for field work)	(84.8)	(243.3)	(62.5)
Factory	8.5	24.4	6.3
Services	6.7	19.3	5.0
GRAND TOTAL	100.0	287.0	73.8

The analysis makes it clear that at least from the standpoint of effecting an overall reduction in labour, plucking and weeding are the two operations most worthy of study. Together they account for nearly three-quarters of the whole labour expenditure on field works; while both go on almost continuously throughout the year. In theory, therefore, any labour that can be saved in either plucking or weeding represents labour that can be dispensed with entirely. Mechanical plucking—which involves questions concerning bush management and quality to which there are no definite answers at present—is discussed in some detail later in this report. In the meantime mechanical weeding provides an immediate illustration of what fairly straight-forward mechanization might accomplish.

Mechanical Weeding

A convenient outfit to consider for purposes of illustration is one of the small tracklaying tractors with an engine of 6 to 7 h.p. that are quite commonly used by large-scale market gardeners in the U.K. There are, of course, other possibilities, e.g. the small 4-wheeled drive tractors that are used in some continental vineyards, or even the two-wheeled "walking" tractors that are used in smaller-scale market gardening. But, on the whole, a small tracklayer seems to offer the best combination of small overall dimensions and manoeuvrability with an adequate output of power. A tractor of this kind would have an overall width of not more than about 3 ft. and could operate without difficulty in 7 ft. tea rows. With appropriate shielding to push longer branches aside it might even operate in 6 ft. rows, but this would be a matter for experiment in the field. The tractor could carry weeding equipment arranged so as to work right up to the boles of the bushes on either side.

The exact nature of the weeding equipment would, again, be a matter for experiment. It might, for example, be an arrangement of shallow working hoes similar to those used in sugar beet and other root crops; or one of the so-called finger

or rod weeders; or even some form of rotary cultivator. It is, however, quite certain that out of the very wide range of light cultivating equipment now available suitable tools for weeding tea rows could be found.

Working in 7 ft. rows at an average of $1\frac{1}{2}$ m.p.h. a tractor mounted outfit of this kind would cover about 10 acres in a day; and, working 25 days per month, would be capable of handling the weeding of 250 acres of tea. If all weeding were done with tractors in this fashion, at the rate of one to every 250 acres, the whole labour force of the estate could be reduced by over 20 per cent.

Some indication of the comparative costs of the two methods may also be of interest. At 53.5 man days per acre the present annual cost of weeding 250 acres of land would be about 27,000 rupees. The capital cost of the tractor outfit would be about 5,000 rupees; and if this were entirely written off in four years, depreciation charges would be about 5 rupees per day. From experience already gained with the tractors now being used for haulage on tea estates the daily running cost, including the driver's wage, would be not more than 20 rupees a day. At the all-in total of 25 rupees a day, the annual cost of weeding 250 acres by tractor would be only about, 6,250 rupees—a saving of over 20,000 rupees, or five times the first cost of the equipment, annually.

Use of Equipment in Other Operations

Deep forking could probably not be done mechanically except at the risk of excessive root disturbance; but the lighter forking that accompanies fertiliser application, and the actual application of fertiliser, could certainly be done in much the same way, and at much the same saving of labour and cost. Indeed, in the long run, the separate items of manure application might disappear from estate estimates altogether. Two out of the twelve annual weedings would be done with a rather deeper-working tractor attachment—with something on the lines of a harrow instead of a hoe—the fertiliser being applied mechanically and more accurately, at the same time.

As a further example of how mechanization may change existing practices: it would almost certainly be desirable to plant the uncovered space between rows (*i.e.* the strip about 3′ wide on which the tractor runs) with some low-growing green crop. It would then be quite practicable to arrange for the tractor to mow this strip, and to windrow the material on to the weeded area under the tea bushes on either side. Moreover, the cutting and windrowing could be done simultaneously with weeding so as to avoid a separate operation.

Finally, there would be no great difficulty in developing a powerdriven sprayer or duster, which could be mounted on the same type of tractor, and which by covering 10 or more rows at a time, would greatly reduce the labour requirement of spraying in just the same way. It is not in any way fanciful to suppose that with equipment of the kind outlined, developed and proven by practical experiment at the Tea Research Institute or elsewhere, labour on field work could be reduced by something like 65 labourers per acre; and the total labour requirement of the estate by something like 25 per cent. This estimate, moreover, is based only on what might be done in weeding, manuring and spraying. The only essential requirements are a contoured bush layout that gives room for the tractor, and reasonable freedom from obstruction and rocks.

Mechanization of Estate Maintenance Services

Now that ordinary tractors are coming into use on many estates for the haulage of leaf and general supplies, it is natural to consider extending their use to road making, timber handling, sawing and so on.

To give only one example, the length of holes for blasting that a mason now accomplishes in a week with a hammer and jumper, could be done with a pneumatic drill operated by a tractor mounted air-compressor in only an hour or two. And on practically every estate visited there were similar jobs to be seen in which some readily available, but not necessarily inexpensive, appliance could be used to enable, say, four workmen to do as much work as now requires ten. But the other six workmen could not be dispensed with entirely; nor was it at all certain that, at that particular moment, they could be profitably employed elsewhere. The real economy of mechanization in such instances was, therefore, open to some doubt. In any case, if the labour analysis given earlier is any guide, the total labour requirement of estate maintenance is so relatively small, and the mechanizable part of it so much smaller, that mechanization in these directions is hardly likely to reduce overall production cost at all significantly.

There are, of course, exceptions; and where an extensive road-making or building programme means bringing in still more labour from outside, or diverting men from other essential work, the case for mechanization will be very much stronger. But in the light of the broader purpose of this survey it was not thought worth while to devote much attention to problems of this kind.

Mechanical Plucking

In a commercial experiment which has been in progress on the Dickwella Estate for rather more than a year, complete records of 32 consecutive rounds of mechanical plucking have been kept. Whatever these and future records may prove in regard to labour and costs, it is clear that mechanical plucking will stand or fall in the long run on its performance in regard to bush management (*i.e.* maintenance of yield) and the manufacturing qualities of the leaf. Nor can conclusive evidence on these points be expected until the experiment has run for at least one complete pruning cycle. In the meantime, only 18 months after pruning, and at least to the inexperienced eye of the writer, the mechanically plucked field appears to have developed a quite outstanding bush cover. The writer would also venture the opinion that if mechanical plucking proves satisfactory from the standpoint of bush management, any short-comings on the manufacturing side will not be difficult to rectify.

Over the 32 plucking rounds so far recorded, mechanical plucking has given an average daily outturn of 56 pounds of leaf per labourer and 112 pounds per machine. This is rather more than double the daily average of 25 pounds per plucker which seems to be commonly accepted as a general standard for hand work. On the face of it, therefore, mechanical plucking offers, as it stands, the possibility of reducing plucking labour by something like 50 per cent, and overall estate labour by a further 20 per cent over and above the saving envisaged in the discussion of weeding, etc.

In the type of equipment now being used each plucker has a self-contained unit driven by a small high-speed 2-stroke engine carried in suitable harness on his back. There is one box carrier to each plucker and the two men change jobs half way through each day's work. Each unit costs approximately 1,000 rupees, and 13 such units are being used on the 50 acres. This number is known to be excessive, and the actual plucking time during each nominal 10-day plucking round amounts only to 5 or 6 days. On the records to date it is estimated that, working as nearly as possible continuously, one unit could deal with 7 to 8 acres. Plucking costs in 1952 averaged just over 30 cents per pound (22.71 for labour and 7.35 for fuel and oil). If the entire first costs of the equipment were to be written off over 4 years, depreciation would amount to an additional 4 or 5 cents per pound. At the moment, therefore, mechanical plucking is not markedly cheaper than hand plucking.

In earlier experimental work the cutting heads were electrically driven, a group of 6 or 8 units being supplied with power through cables from one centrally-situated generator set. But this generator set could not be manoeuvred into the tea; it could

get no nearer than an adjacent field path, and long cables had to be used to give the pluckers sufficient mobility. It is probable it was the general inconvenience of threading long cables in and around closely planted tea bushes that led to this system being abandoned—in any case, the wear and tear of cables would be likely to be prohibitive.

If, however, in the light of what has been written earlier, it becomes practicable in the future for power to be supplied at comparatively short range from a mechanically-propelled power unit which can manoeuvre actually in the tea rows, the economics of mechanical plucking should be greatly improved; by more systematic working, and by the elimination of most of the box-carrying labour. Indeed the writer would go further and suggest that, if only from an experimental standpoint, the possibility of pruning the bushes mechanically to a plucking surface plane enough to permit of fully-mechanical plucking ought not to be overlooked. In this conception the whole row would be pruned originally, and plucked from then on, by a wide cutter bar attached to, and driven by, the tractor. It would be easily within the compass of such an outfit to prune or pluck over 3,000 bushes an hour, or 7 to 8 acres a day with one man.

If mechanical plucking in its present form proves satisfactory as regards bush management and quality, there is, in the writer's view, nothing fanciful about extending the process still further on these lines. Moreover, the potential savings of labour and cost are great enough to warrant the expenditure of a considerable effort on the necessary experimental work.

Arrangement of Replanting

The following notes are intended as a basis for experiment rather than as a guide to immediate practice. The spacing now commonly adopted in new clearings in which the bushes are $1\frac{1}{2}$ feet apart in contour "hedges", which are themselves 5 feet apart, it too close to be worked by tractor in the manner outlined earlier.

A better arrangement, giving exactly the same overall bush density of 5,808 bushes per acre, would be to space the rows alternately at 3 feet and 7 feet so as to give the effect of double hedges ($3 \times 1\frac{1}{2}$) with 7 foot intervals between. But with this arrangement only the wide rows could be tractor worked; and all weeding, and possibly all fertiliser distribution, between the 3 feet rows would still have to be done by hand. With this in mind, and unless it can be shown by experiment that the extra labour requirement of the double hedge will not be serious, a still better arrangement would be to have single rows 7 feet apart to give an overall bush density of about 4,150 bushes per acre.

In either case, a clear space of about 3 feet would need to be left as turning room for the tractor at both ends of every row; as well as on all sides of any boulders or rocky outcrops that might be included in the area. All shade trees should be palnted in the tea rows.

In order to economise both turning space and turning time, the rows should obviously be as long as possible. Indeed, in planting replanting programmes it might be well worth while to consider working in strips instead of in blocks; the strips being as long as such natural obstacles as deep ravines would allow. Working in this way the area of, say, 10 acres selected for clearing in any one year might be a strip up to a mile long and only about 30 yards wide; similar strips being added in subsequent years. This procedure might also simplify the operation of lining out rows and drains, over which, in any case, great care would need to be taken so as to avoid awkward short rows and other hindrances to economical working.

Mechanization of Replanting

Apart from the mechanical pulling out of old bushes, which is a relatively straight-forward matter, it has not been possible in the short time available to reach any very definite conclusions on this subject. So little replanting with vegetatively propagated material has yet been done that there is no settled procedure, nor any definite standard of costs against which to judge the possibility of effecting reductions by mechanization.

In almost all circumstances the pulling of bushes by mechanical winch is likely to be far cheaper than grubbing them out by hand. In one instance, using a tractor-mounted winch—the over-all cost of which, including the driver and four other labourers, should not have exceeded 32 rupees a day—bushes are being pulled at an average rate of about one a minute. Winching has the added advantage that it disrupts the soil as effectively as a separate sub-soiling operation. Mechanical bush-pulling has also been done satisfactorily with portable engine-driven winches; but the over-all rate of work is slower, and the cost higher, than with a tractor. Where it is proposed to fit winch attachments to the tractors already used for haulage, a word of caution may not be out of place. Dynamometer measurements made on two estates showed that the uprooting of quite ordinary-looking bushes may need pulls of over 8,000 pounds. This work is, therefore, rather too heavy for the winches of 5 tons nominal capacity that are commonly fitted to light haulage tractors.

Following the clearing of old bushes from reasonably level land (*e.g.* with slopes not exceeding 1 in 7) almost any kind of tractor could be used economically for preparing the land for replanting. The practice now generally recommended is to "build up" the soil by digging contour trenches along the proposed replanting lines and lopping green manures into them over a period of from 18 months to two years, before finally re-covering with soil. On reasonably level land the trenching, lopping and refilling could all be done with readily available tractor equipment with considerable economy of man power and cost; but it is unlikely that more than about 20 per cent of the whole Ceylon tea area would, in fact, be level enough to be handled in this way. On a much greater proportion of the whole tea area—with slopes ranging from 1 in 7 up to, say, 1 in 3—mechanical preparation for replanting would still be practicable, but only with special equipment still to be designed. The writer has in mind a special tractor, somewhat resembling a motor cycle with side car in general layout, with one drive wheel (or track) one steering wheel and one adjustable stabilizer wheel. This would do relatively light work by direct traction, or heavier work by winching itself along.

Excluding preliminary costs of development, an appliance of this kind should not cost more than an ordinary tractor; and should enable one man to dig contour trenches at 20 to 30 times the rate of ordinary hand work. The potential market for such an appliance would, however, be too small to interest large-scale manufacturers; and equipment of this kind is unlikely to be forthcoming unless development is fostered and financed independently.

One advantage of the trenching procedure just mentioned is that the land seems afterwards to fall naturally and fairly rapidly, into contour terraces, which are subsequently stabilised by the tea rows themselves. To judge from the new clearings at the Tea Research Institute this automatic falling of the land into terraces will generally happen quickly enough for the small tractors that are afterwards to be used for weeding, etc. to be first introduced at the time that the young plants are put out. They could, therefore, be used to cheapen upkeep over the next two or three years, and so still further reduce overall replanting costs as these are reckoned at present. On the whole, however, the figure of 3,500 to 5,000 rupees per acre,

now commonly quoted for replanting,includes so many odd (and probably unmechanizable) items that, without more sear ching enquiry, the writer would doubt whether any kind of mechanization can effect an overall reduction of more than one-third of present costs.

Conclusions

With Ceylon tea as it is planted and organised at present, there is little prospect of lowering production costs by mechanization. But given the more appropriate bush pattern that could be introduced wherever tea is replanted, or new tea opened, there is every prospect that, by fairly straight-forward mechanization, the present labour requirement of tea growing could be reduced by at least 50 per cent.

In the writer's considered view, therefore, there is a very strong case for giving serious attention to mechanization in direct association with replanting, and for instituting the further enquiry and experimentation necessary to bring it to practical fruition.

Broadly speaking, experimental work will be required in three directions. First, although most of the basic equipment mentioned in this report is already commercially available, a great deal of minor development, and adaptation by trial and error in the field, will be required in order to fit in to an entirely new purpose. Secondly, in tea as in every other crop to which it has been applied, mechanization will bring about the changes in method: so much of present tea cultivation practice seems to have evolved from the existence of an over-abundant labour supply, that to re-examine the whole agronomy of the crop in the light of mechanical working, is likely to pay handsomely in the long run. Finally,the whole question of bush pattern and the layout of new clearings clearly needs more careful study on the ground itself than the necessarily hurried survey on which this report is based. Moreover, on this point alone, there is likely to be a demand for advisory assistance that will be quite beyond the present resources of the Tea Research Institute of Ceylon.

Generally the work will demand ample funds; the services of men of first-class ability in agricultural engineering; the co-operation of estates; and a close liaison between the tea industry and machinery manufacture in the United Kingdom and elsewhere.

THIRTEENTH INTERNATIONAL HORTICULTURAL CONGRESS 1952

G. B. Portsmouth

The Thirteenth International Horticultural Congress, which was held in London from the 8th to the 15th September, 1952, was a memorable one, since it was the first occasion on which the Congress had been able to meet since before the Second World War.

This 1952 meeting will also be remembered for the introduction of a new section of the Congress, Section VII devoted exclusively to Tropical and Sub-Tropical Agriculture. The increasing importance of the contributions to general horticulture, which are now being made by the various research stations working on tropical plantation crops, thus receives international recognition.

With the introduction of this new section the Congress now comprises seven sections as under:—

I. Fruit Growing.
II. Vegetable Growing.
III. Ornamental Plant Growing.
IV. Plant Breeding.
V. Environmental Control.
VI. Seeds.
VII. Tropical and Sub-Tropical Horticulture.

The complicated arrangements for this very large Congress were admirably handled by the Royal Horticultural Society and Section Meetings were held both in the Society's Halls and at the Church House, Westminister. The general meetings and lectures all took place in the Assembly Hall of the Church House, which was the only hall capable of comfortably seating at one time all the 500 or more delegates.

The very full programme comprised more than 140 general and sectional lectures, and it is a matter of regret that owing to the simultaneous meetings of several sections, it was often necessary to choose which of two equally interesting lectures to attend. Fortunately printed copies of the majority of the section lectures were made available to members, but inability to attend a lecture in person meant missing what was often a very valuable discussion.

The very excellent series of general lectures given to the whole Congress each morning were delivered by scientists of world wide repute. Of these, the very fine performance of Professor F. G. Gregory F.R.S., Director of the Research Institute of Plant Physiology, Imperial College of Science and Technology, in tracing the development of plant physiology from its early crude beginnings into one of the exact sciences, in his lecture on "*The control of growth and reproduction in plants by environment factors*", was of special interest.

Another interesting lecture was that delivered by Professor T. Wallace, Director of Long Ashton Research Station, on "*Some aspects of the mineral nutrition of horticultural plants*". In this connection it gives me much pleasure to see that Professor Wallace has just been elected a Fellow of the Royal Society.

Apart from these general lectures my main interest was naturally centered on Section VII, at which I myself gave a lecture on "*The control of blister blight disease of tea*", at the session devoted to crop control and protection. This paper deals with the work carried out by the staff of the Tea Research Institute in connection with the control of this disease in Ceylon, all of which has already been published in this journal and elsewhere, and need not therefore concern us further.

In all some four afternoon sessions of Section VII were held, one of which was exclusively devoted to citrus problems. Apart from this session, the lectures most likely to be of interest to us in Ceylon are briefly mentioned below:—

DR. H. EVANS (Trinidad) "*Physiological aspects of the propagation of cocoa from cuttings*". This paper discusses the various factors involved in the successful rooting of cocoa cuttings and describes new "hardening" techniques.

DR. E. D. C. BAPTIST and C. W. BROOKSON (Malaya) "*Recent progress in Malaya in the breeding and selection of clones of Hevea brasiliensis*". This paper describes the improvements resulting from the first two programmes of R.R.I. hand pollinations, which have been made use of in planning the third programme, now in progress.

DR. WILSON POPENOE (Honduras) "*The development of tropical American pomology*". This paper deals with the cultivation of many varieties of fruits under tropical American conditions.

DR. T. EDEN (Kenya) "*The nutrition of a tropical crop as exemplified by tea*". In this paper Dr. Eden summarises the conclusions he has drawn from the field experiments which he laid down and carried on for some 18 years at St. Coombs.

A. F. POSNETTE (U.K.) "*Virus diseases of cocoa in West Africa*". In this paper Mr. Posnette, who has recently returned from West Africa, discusses the factors involved in the spread of swollen shoot disease and the difficulties which will have to be overcome before any degree of successful control can be established.

Mention may also be made of the paper on Krilium Soil Conditioner given at a joint session of Section I, II and III by Drs. A. J. Lloyd and C. E. Morgan, of Monsanto Chemicals Ltd., which describes the properties of this substance and the various field trials which were carried out with Krilium before it was finally placed on the market.

All the lectures given at the Congress will be published as papers in the report which is now in course of preparation. This should merit considerable study when it is eventually received, since many of the problems discussed in relation to non-tropical crops have an indirect bearing on our own problems.

Apart from the actual lectures, one of the most valuable features of international gatherings of this kind is the opportunity they afford for meeting old friends and scientific colleagues from all parts of the world. This aspect of the Congress was not neglected by the organisers and on the Tuesday evening there was a Government reception at Ashburnham House, Westminister, for delegates and their wives at which Sir Thomas Dugdale, the Minister of Agriculture and Fisheries, received the guests. This was followed on the Thursday evening by a reception in Guildhall, when we were received by the Lord Mayor and Lady Boyce and were given an opportunity of inspecting some of the City's most historic treasures.

The social activities of a most enjoyable week were brought to a fitting climax by a dinner given by the Royal Horticultural Society on the Friday evening in honour of the Committees, lecturers and delegates attending the Congress, which was held in their New Hall, under the Chairmanship of Lord Aberconway, President of the Society.

Some idea of the various nationalities amicably brought together in this Congress may be obtained from the fact that in response to the Congress toast, proposed by Sir Edward Salisbury, a reply was given by Jonkheer G. F. Van Tets Van Goidschaixoord (Netherlands): while in response to the Visitors' toast, proposed by Lord Aberconway, replies were made by Professor P. Chouard (France), Professor H. B. Tukey (U.S.A.) and Mr. A. M. W. Greig (New Zealand).

On the conclusion of the Congress, members were given an opportunity of taking part in an extensive programme of day excursions, which had been arranged to visit various famous gardens, nurseries and horticultural and agricultural research stations within easy reach of London. For the more venturesome spirits a tour allowing three whole days in Scotland was also available.

Finally, I would like to take this opportunity of expressing my appreciation of the very great trouble which must have been taken by the organisers to make this Congress such a valuable and memorable occasion for those privileged to attend.

QUESTIONS AND ANSWERS ON BANJI AND PLUCKING

W. H. W. Coultas & G. B. Portsmouth

The following questions by Mr. W. H. W. Coultas were put to the Plant Physiologist for reply at the Meeting of the Dickoya District Planters' Association on 29th June, 1953. By general request the answers are now published in this Journal.

Question 1—Does banji represent a pathological condition of a tea bush, or merely bad plucking?

Answer—Banji is essentially a resting state of the terminal bud, whose onset is determined by the physiological condition of the shoot. It is a perfectly natural condition and no definite connection with plucking practice has so far been satisfactorily established.

Question 2—In other words would feeding the bush and maintaining it in a healthy and vigorous state reduce the amount of banji?

Answer—In a paper on "the Length of the Pruning Cycle" given at the 1937 Conference, Dr. Tubbs'[1] produced evidence showing that the percentage of banji tended to increase as the cycle progressed. He attributed this result to increasing internal competition between the different shoots for nutrients, as the total number of shoots borne by the bush increased, with age from pruning.

The marked rate of increase in the percentage of banji, which he found at the beginning of the cycle, may well be attributed to this cause, if we remember that, at the time these observations were made, very hard clean pruning was usual and that there would therefore be a very rapid increase in the total number of shoots produced by the bush during the early part of the cycle. Once, however, a cover of tea is re-established, and is being regularly plucked, I am inclined to think that the age from pruning has little or no effect on the banji percentage. This is actually borne out by Dr. Tubbs' own data, since at 1500 days from pruning the percentage of banji is 46.1% compared with a figure of 46.2% at only 625 days from pruning. Under these conditions therefore it appears probable that most of the fluctuations in the amount of banji produced are caused by changes in weather conditions and the availability of plant food as applied fertiliser. Shortage of manure will almost certainly lead to a large increase in banji.

Question 3—Are certain bushes more prone to the production of banji than others?

Answer—We have no direct experimental evidence on this point but, from my own experience, I would agree that certain clones tend to produce a higher percentage of banji than others.

Question 4—Is there any information available regarding the time it takes for new flush to grow from where the banji leaf has been removed?

Answer—From a series of extensive field observations, carried out on clone T4 last year, I am able to provide the following figures for the average times taken for new shoot production[2]. In each case the times given are those taken for the production of pluckable flush, which is defined as when the third leaf is clear of the bud.

(a) From flush plucked to new flush—81 days.
(b) From flush plucked to pluckable banji—75 days.
(c) From banji plucked to new flush—83 days.
(d) From banji plucked to pluckable banji—79 days.
(e) From banji left on bush to new flush—84 days.

There is very little difference between any of these times, which are all around 11 to 12 weeks. Accordingly, on the assumption that only one new shoot is produced for each shoot plucked, plucking or not plucking banji makes practically no difference whatsoever to the number of new flush shoots produced. However, it must be borne in mind that, if a policy of plucking soft manufacturable banji is followed, the yield will be increased by the weight of the banji plucked.

Question 5—Would you say there is any object in removing banji from plucking tables 6 - 3 months before pruning?

Answer—There is no reason to make this a special case. Banji should always be plucked while it is still soft and suitable for manufacture, otherwise crop will be lost.

Question 6—Is there scientific support for the fairly universal practice of keeping the centre of the bush flat by removing high branches, especially what are known as "koli kal vathu" or "chickens' foot" branches?

Answer—The fact that "koli kal vathu" have been allowed to develop is a sign of bad plucking. However, if these have developed, they must be removed, otherwise it will be impossible to keep the bush down to a reasonable plucking level. The reason for not permitting such high branches to develop in the first place is that, when they are removed, a large number of potential plucking points are removed with them, resulting in a temporary set back in cropping.

Question 7—Is there any scientific support for the assertion that slope pruning and plucking increase yields?

Answer—On the assumption that there is no overlap of plucking tables in the case of a horizontally pruned field, it is merely a matter of simple geometry to see that slope pruning allows the development of a greater area of plucking surface. Accordingly slope pruning and plucking should be capable of giving increased yields.

Question 8—Does the T.R.I. recommend slope pruning and plucking?

Answer—Subject to the warning which I gave at our last Conference, regarding the danger of cutting away the frame on the lower side of the bushes when pruning to a slope[8], we recommend slope pruning and plucking for the following reasons:—

(a) Greater yield capacity.
(b) Absence of over shadowing of one bush by another, which may lead to pockets of blister blight infection.
(c) Easier spraying and dusting.
(d) Easier supervision, since every bush in the field can be clearly seen from a facing slope.
(e) Much neater appearance.

REFERENCES

(1) TUBBS, F. R.—The Length of the Pruning Cycle. *Tea Quarterly* X, p. 21, 1937.
(2) PORTSMOUTH, G. B. & RAJIAH, E. S.—Unpublished Data.
(3) PORTSMOUTH, G. B.—The Principles of Bush Management. *Tea Quarterly*, XXIV, p. 17, 1953.

STUDIES IN BLISTER BLIGHT CONTROL

XII. DUSTING AND SPRAYING AGAINST BLISTER BLIGHT ON URY GROUP, PASSARA

C. A. Loos

Introduction

A power-dusting experiment to ascertain the efficacy of "Cuprosana" copper fungicidal dusts of 2, 4 and 6 per cent copper content, was conducted on Dessford Estate, Nanu Oya, during the south-west monsoon months in 1950. The full results of that experiment have been published in the *Tea Quarterly* [1]. Using the "Whirlwind" power duster we had definite indication of effective blister blight control, with the 4 and 6 per cent "Cuprosana" formulations, provided an adequate distribution of copper in the dusts was possible, and application rates were 5 lbs. an acre at 5 day intervals. It was also clear that adequate distribution of copper was confined to a band 25 yards from the machine with 4 per cent, and 50 yards with 6 per cent "Cuprosana". These results confirm Haworth's [2] conclusions of the rapid fall in the distribution of copper from a cloud of copper fungicidal dust, as the distance from the dusting point increased.

The promising results achieved with 4 per cent "Cuprosana" indicated that, by a more suitable and effective means of distributing the dust, economical control of blister blight may be possible in areas where water for spraying is not easily accessible or labour shortage is a factor to be considered. The experiment reviewed in this article compares the control of blister blight in tea with 4 per cent. "Cuprosana" dust applied by means of power duster or hand duster with wet spraying by means of knapsacks.

The areas selected for the experiment were two fields, Nos. 7 and 8, totalling 116 acres 2 roods 35 perches, on the Mahapahagalla Division of Ury Estate, Passara (Elevation 3,500—4,200 feet).

Each field was divided into four blocks, each block receiving one of the following treatments:—

(a) 4 per cent "Cuprosana" dust at approximately 5 lbs. per acre through hand dusters. The operators walked through the tea dusting bands 5 rows wide (approximately 15 feet).

(b) 4 per cent "Cuprosana" dust at 5 lbs. per acre every 5 days through the "Whirlwind" power duster. Dusting was done from roads and footpaths only.

(c) Wet spraying by means of the "Vermorel" knapsack sprayer with "Perenox" at a concentration of 4 ounces in 10 gallons water applied at approximately 15 gallons per acre at 10 day intervals.

(d) Unprotected with either dust or spray.

Field No. 8—43 acres 2 roods 18 perches. A first year field of fairly high jat tea pruned and tipped on the slope.

Hand dusted	16.5 acres
"Whirlwind" dusted	20.0 „
Sprayed	5.75 „
Unprotected	1.33 „

Field No. 7—73 acres 17 perches. A second year field of fairly good hybrid tea; level pruned.

Hand dusted	16.5 acres
"Whirlwind" dusted	25.0 ,,
Sprayed	9.0 ,,
Unprotected	6.0 ,,

A $5\frac{1}{2}$ acre block of this field remained outside the experiment.

Duration of Experiment. The experiment commenced on September 27th, 1951 and continued until the end of September 1952 during which time crop returns from individual treatments were recorded. Protection with fungicides commenced on September 27th, 1951, and continued until the end of the north-west monsoon rains on February 20th, 1952.

Crop Returns. This may be divided into three categories:—

(1) Plucks 1 - 7 (October 4th, 1951 to December 4th, 1952) which may be considered to be the period before blister blight built up sufficiently to cause loss of crop.

(2) Plucks 8 - 14 (December 5th, 1951 to February 11th, 1952) when the effects of blister blight caused die-back and loss of crop.

*s*3) Plucks 15 - 40 (February 12th, 1952 to October 8th, 1952) or the post blister period.

It should be clearly borne in mind that in the power dusting experiment in which the subsequent carry of the dusts for long distances cannot be controlled, replication of treatments necessary for statistical analysis of yields is not possible. Yield returns on this experiment are, therefore, of little significance except as an indication of probable losses due to blister blight. No allowance can be made of inherent variability of bushes or for the possible range in character of soil fertility between plots. That could only be done on sufficient replications of treatments which in the present case was not possible. We have, therefore, to rely on marked differences in crop returns showing up between treatments for any reliable indication of superiority of control between spraying and dusting or in the method of application of the dust.

In tables 1 and 2 the yield capacity per acre for the pre-blister period (plucks 1-7) has been assessed at 100 and the yield capacity during the blister and post-blister periods compared with it on the basis of that assessment.

Table 1. *Field No.* 8. (*First year field*) *crop returns for period* 4*th, October,* 1951—8*th, October,* 1952, *expressed as yield capacity compared with pre-blister period.*

Pluck No.	"Whirlwind" dusted	Hand-dusted	Sprayed	Unprotected
1 - 7 (pre-blister)	100	100	100	100
8 - 14 (blister period)	86	77	79	38
15 - 40 (post-blister period)	148	152	157	107

Table 2. *Field No. 7 (2nd year field) crop returns for period 4th, October, 1951—8th, October, 1952, expressed as yield capacity compared with pre-blister period.*

Pluck No.	"Whirlwind" dusted	Hand-dusted	Sprayed	Unprotected
1 - 7 (pre-blister)	100	100	100	100
8 - 14 (blister period)	67	79	80	46
15 - 40 (post-blister period)	119	122	122	131

Both fields showed a decided fall in crop on the unprotected areas during the blister blight period (plucks 8-14), the first year field (No. 8) being more severely affected than the field in the 2nd year of its cycle (Field No. 7). In the post-blister period, however, the unprotected area of No. 7 field (2nd year field) had recovered sufficiently to give a yield potential as high or higher than on the protected areas (131 compared with 119-122). On No. 8 field (first year field) the yield capacity on the unprotected area had definitely been affected by the severe blister blight attacks as during the post-blister period the yield potential was only 107 compared with 148-157 on the protected areas. On these figures we may assume that it is necessary and economic to protect 1st year fields though protection of fields which have run longer in the cycle may not be economic. On yield returns alone there was no apparent difference between protection with fungicidal dusts or spray.

Efficacy of protection. A number of observation points were marked in each area and observations made at those points at each plucking until protection ceased at the end of February. The following key was used to assess the blister incidence:—

0—no infection.

1—slight infection on leaves observed without undue searching.

2—fairly heavy leaf infection.

3—very heavy leaf infection.

4—light die-back following stem infection.

5—fairly heavy die-back.

6—almost total loss of plucking shoots.

Between 12th, and 15th, February, 1951 (1½ months after the experiment commenced) assessments on both No. 7 and No. 8 fields showed an almost complete absence of infection, observations at all points being assessed at 0.

Table 3 shows the assessment of the incidence of blister blight made on January 19th, 1952 (No. 8 field) and Table 4 that made on January 22nd, 1952 (No. 7 field) during the height of the blister attacks.

Table. 3. *Field No.* 8. *Blister incidence at observation points on* 19-1-52.

Observation post No.	"Whirlwind" dusted area		Hand-dusted area		Sprayed area		Unprotected area	
	Incidence	Avg:	Incidence	Avg:	Incidence	Avg:	Incidence	Avg:
1	1 - 2	1.5	1	1.0	0 - 1	0.5	3 - 4	3.5
2	1 - 2	1.5	1	1.0	0 - 1	0.5	4 - 5	4.5
3	1 - 0	0.5	1 - 2	1.5	0 - 1	0.5	3 - 4	3.5
4	1 - 2	1.5	1 - 2	1.5	0	0	2 - 3	2.5
5	1 - 0	0.5	0 - 1	0.5	0 - 1	0.5	3 - 4	3.5
6	1 - 2	1.5	2- 1	1.5	0	0	3 - 4	3.5
7	2 - 1	1.5	1	1.0				
8	1 - 2	1.5	1	1.0				
9	1	1.0	1 - 2	1.5				
10	2 - 3	2.5	2 - 1	1.5				
11	1 - 2	1.5	1	1.0				
12	2 - 3	2.5	1 - 1	0.5				
13	3 - 4	3.5						
14	1 - 0	0.5						
Average		1.5		1.0		0.3		3.5

Table 4. *Field No.* 7. *Blister incidence at observation points on* 22-1-52.

Observation Post No.	"Whirlwind" dusted area		Hand-dusted area		Sprayed area		Unprotected area	
	Incidence	Avg:	Incidence	Avg:	Incidence	Avg:	Incidence	Avg:
1	2 - 1	1.5	1 - 2	1.5	0 - 1	0.5	3 - 2	2.5
2	1 - 2	1.5	1	1.0	0 - 1	0.5	3 - 2	2.5
3	1 - 2	1.5	2 - 1	1.5	0 - 1	0.5	3 - 4	3.5
4	1 - 2	1.5	1	1.0	0 - 1	0.5	3 - 4	3.5
5	1 - 2	1.5	1	1.0	0 - 1	0.5	3 - 4	3.5
6	2 - 1	1.5	1 - 0	0.5	1 - 0	0.5	3 - 2	2.5
7	1	1.0	2 - 1	1.5			2 - 3	2.5
8	1 - 2	1.5	1 - 2	1.5			2 - 3	2.5
9	1 - 2	1.5	1	0.5			2	2
10	1	1.0	1 - 2	1.5				
11	2	2.0	1 - 2	1.5				
12	2	2.0	2 - 1	1.5				
13	1 - 2	1.5	1	1.0				
14	3 - 4	3.5	1 - 2	1.5				
15	1 - 2	1.5	2 - 1	1.5				
16	2 - 1	1.5	1 - 2	1.5				
17	2 - 3	2.5	1 - 2	1.5				
18	2 - 1	1.5	1 - 2	1.5				
Average		1.7		1.3		0.5		2.8

From tables 3 and 4 it is obvious that the most efficient form of protection was by spraying. With hand dusting there was not any observable die-back of plucking shoots but on the "Whirlwind" dusted area points which were difficult or impossible to cover adequately from roads or footpaths (Table 3 No. 13, and Table 4 No. 14) showed die-back caused by stem blisters. The unprotected area, however, showed die-back and heavy incidence of blister at nearly all observation points. Though there was no doubt that the best method of control was by spraying, dust protection under the conditions of this experiment was sufficiently adequate to avoid die-back of plucking shoots. A typical crop return (Table 5) for pluckings on 19/1/52 and 11/1/52 show the depression of crop between the unprotected areas

and those areas receiving fungicidal protection. On those occasions the unprotected areas were hardly worth plucking and gave only 1/5th to 1/7th of crop obtained from the protected areas.

Table 5. *Crop returns on* 19-1-52 (*No.* 8 *Field*) *and* 11-1-52 (*No.* 7 *Field*) *at a plucking during the blister season. Crop expressed as pounds made tea per acre*

	No. 8 Field	No. 7 Field
"Whirlwind" dusted area	16	11
Hand-dusted area	14	13
Sprayed area	15	15
Unprotected area	3	2

Cost of Protection. The "running" cost has been worked out for the period December 1951—February 1952 and averaged as costs for each 10 day plucking round (Table 6). In the case of spraying, applications were made once each plucking round on the day after plucking and with dusting twice at 5 day intervals. There was a total of 16 pluckings during the protection period. Costs are worked out at 44 cents per pound of "Cuprosana" 4 per cent copper dust, and 11 cents per pound of "Perenox" which were prices prevailing during the time of the experiment. Labour costs for application are included but supervision, beyond that of the supervising kangany is not shown, as it could not be accurately assessed. Dusting received as much specialised supervision as spraying. Costs of machines or depreciation of equipment are not assessed.

Table 6. *Running costs on Fields* 8 *&* 7 *per plucking round of* 10 *days.*

	"Whirlwind" dusted area		Hand-dusted area		Sprayed area	
	Field 8	Field 7	Field 8	Field 7	Field 8	Field 7
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Total protection costs	4/56	4/54	5/19	5/15	2/74	2/97
Cost of labour for protection	-/16	-/14	-/28	-/35	2/03	2/33
Cost of fungicide	4/40	4/40	4/90	4/80	-/71	-/64
Cost of fungicide expressed as % of total cost	96%	97%	94%	93%	26%	22%

Taking the average over both fields, the "running" cost of protection per acre per plucking round was as follows:—

"Whirlwind" dusting	Rs. 4/55 per acre	Exclusive of all depreciation of equipment.
Hand-dusting	Rs. 5/17 „ „	
Spraying	Rs. 2/86 „ „	

Retention of Copper. The retention of copper was in all cases higher where the fungicide was applied as a wet spray. The amount of copper in teas made from the protected areas were well below the permitted amounts.

Summary

Yield records did not reveal any difference between the relative efficiency of dust and spray protection. Blister incidence measurements, however, showed clearly that spray protection gave better control than dust. The protection of the first year field was economic and necessary but it appears possible that on a second year field, although adequate protection of crop was secured during the blister season, recovery and cropping potential of the bushes were not adversely affected during the post-blister period. The "running" cost of dusting was more expensive than that of spraying.

Acknowledgments

We gratefully acknowledge the generosity of the Directors of the Mahavilla Estates Company, Limited, and their Agents, Messrs. George Steuart & Company for permission to conduct the experiment on the Mahapahagalla Division of Ury Estate, Passara. Our special thanks are also due to Mr. B. C. V. Weeks, the Manager of Ury Estate, and his assistant, Mr. C. L. Fernando, for their willing co-operation and help during the experiment. Mr. C. L. Fernando gave invaluable help in the organisation of labour and supervision. Mr. E. S. Rajiah of the Physiology Department, was in charge of the experiment from November 1951 until the end of February 1952 and I wish to express my appreciation of his efficient work. I also wish to thank Mr. Austin and the Staff of the Passara Sub-Station for their co-operation.

REFERENCES

1. Loos, C. A. "Studies in Blister Blight XI. Dusting against blister blight on Alupolla Estate, Ratnapura. *Tea Quarterly*, Vol. XXIII (III) 1952, pp. 76-80.

2. Haworth, F. Distribution of copper containing dusts. *Tea Quarterly*, Vol. XXII (III) pp. 118-120.

MINUTES OF MEETING OF THE BOARD OF THE TEA RESEARCH INSTITUTE OF CEYLON HELD AT THE OFFICES OF THE PLANTERS' ASSOCIATION, 133, STEUART PLACE, COLOMBO, ON FRIDAY, 19TH DECEMBER, 1952 AT 2-30 P.M.

Present. Mr. R. C. Scott, C.B.E. (Chairman), Dr. A. W. R. Joachim, M.B.E. (Director of Agriculture), Mr. W. H. Gourlay (Chairman, Agency Section, Planters' Association of Ceylon), Mr. W. R. Vander Kiste (Chairman, Planters' Association of Ceylon), Messrs. G. K. Newton, W. Neal de Alwis, M.P., J.P., U.M., Errol Jayawickreme, J.P., U.M., G. J. Harris, D. E. Hettiarachchi, J.P., U.M., A. D. McLeod and J. Lamb (Director and Secretary).

1. Notice convening the meeting was read.

Letters regretting inability to attend were received from Messrs. A. J. Dickson, H. S. Hurst and A. G. Ranasinha, C.M.G., C.B.E. (Secretary to the Treasury).

2. The minutes of the meeting of the Board held on 21st November, 1952, were confirmed.

3. **Minutes of the Meeting of the Estate & Experimental Sub-Committee held on 6th December, 1952.**

Copies of these minutes were issued to members under cover of Circular No. A. 18/52 of 13th December, 1952. The chief business of the meeting was the consideration of the St. Coombs Estate Estimates for 1953.

4. **Visiting Agents Report dated 9th December, 1952**

Commenting on the very comprehensive report on a visit paid to St. Coombs Estate by the Visiting Agent (Mr. G. K. Newton), the Chairman said that reference had been made to several items included in the estimates for 1953.

5. **Finance**

Estimates for 1953.

(i) Revised Forecast of Receipts & Expenditure for 1952.

It was noted that the revised forecast did not show any appreciable difference from that presented to the Board last December.

(ii) Forecast of Receipts & Expenditure for 1953.

The Chairman pointed out that for estimating purposes receipts from cess was set at Rs. 750,000, a figure based on the collections for the last two years. Profit from St. Coombs Estate was once more estimated at Rs. 40,000 and with Miscellaneous Receipts at Rs. 7,500 total receipts for 1953 were estimated at Rs. 797,500.

Against the above income, revenue expenditure for 1953 is estimated at Rs. 777,320 leaving a surplus of Rs. 20,180. Capital expenditure however totalled Rs. 280,650. The final position therefor would be a deficit of Rs. 260,470. This figure would, however, on the recommendations of the Finance Sub-Committee, be reduced by Rs. 42,000/-.

(iii) St. Coombs Estate Estimates for 1953.

The Chairman reported that the estimates had been scrutinised first by the Estate & Experimental Sub-Committee on 6th December and then by the Finance Sub-Committee that morning. He would therefore proceed to the consideration of the estimates forthwith.

Revenue Account. The Chairman informed members that the Finance Sub-Committee had agreed to accept subject to further consideration by the Estate & Experimental Sub-Committee the figure of 260,000 lb. as the total amount of crop from St. Coombs.

The St. Coombs Estate estimates for 1953 were approved on the proposal of Mr. W.Neal de Alwis seconded by Mr. Errol Jayawickreme.

(iv) Research Estimates for 1953.

The Research estimates were approved on the proposal of Dr. A. W. R. Joachim seconded by Mr. A. D. McLeod.

6. Staff

(i) Pathologist—Mr. C. A. Loos.

It was reported that Mr. C. A. Loos had returned to Ceylon on 30th November, 1952, after having completed his scholarship at Rothamsted. He had since resumed duties at St. Coombs.

The Director said that he had received a very favourable report from Dr. T. Goodey which he would circulate to members.

(ii) Agricultural Chemist—Mr. J. A. H. Tolhurst.

The Director reported that Mr. Tolhurst had accepted the appointment of Agricultural Chemist. There was a possibility of his being released in February for a month's course at Harwell after which he would return to Long Ashton to complete the agreed period for his notice of resignation. Mr. Tolhurst hoped to sail for Ceylon in April.

7. Small Holdings Advisory Service

Copies of the Minutes of the meeting of the Small Holdings Sub-Committee held on 20th November, 1952, had been issued to members. Attached to the minutes were the estimates for 1953 which had been approved by the Committee.

8. Any Other Business

(i) Publications.

The Director reported several hundred copies of both the Monographs on Tea Production No. 1 and 2 remain unsold. He explained that on account of the heavy costs of printing these it was decided to sell them at Rs. 2/50 and Rs. 3/- respectively but the response had been very poor. It was, however, estimated that the costs incurred had been about recovered.

Mr. W. H. Gourlay agreed as a preliminary step to circularise Agency Houses with a view to helping in disposing of these valuable publications. The Director could then take what action he thought best. Agreed.

(ii) Visit of Mr. S. J. Wright.

The Director informed members that as a result of a visit paid about a year ago by Mr. S. J. Wright, formerly Director of the National Institute of Technical Engineering, an application had been made under the Colombo Plan for technical advice on the mechanisation of tea cultivation.

The application had been entertained and information received that Mr. Wright was due to arrive in Ceylon at the beginning of February 1953. His stay at the Institute would last six weeks and St. Coombs would be his headquarters. The Institute has been asked to meet his subsistance and travelling expenses.

He asked for the Board's approval for a vote of Rs. 1,200/- to cover Mr. Wright's subsistance allowance and Rs. 750/- for his travelling expenses. Approved.

(iii) Conference.

The Chairman drew the attention of the members to the fact that it had been decided at the last Board meeting to hold the next T.R.I. Conference at the Regal theatre, Nuwara Eliya, on Friday, 6th March, 1953.

The Director said that it was intended to make an atempt to clarify the more confusing points of policy in regard to agricultural problems by opening up general discussions on such points.

It was agreed that such items as manuring, shade, weeds, etc., should be raised.

Mr. W. H. Gourlay suggested that arrangements for the Conference should be left in the hands of the Director. Agreed.

The Chairman paying a tribute to the Director said that Mr. Lamb was maintaining the prestige of the Tea Research Institute by the tremendous amount of work he had carried out so efficiently.

He then wished all members a Happy Christmas and a bright New Year.

The meeting ended at 4 p.m. with a vote of thanks to the Chair.

(Sgd.) J. LAMB,

Secretary.

Tea Research Institute of Ceylon,
St. Coombs,
Talawakelle.

PRINTED BY H. W. CAVE & CO., LTD., COLOMBO.

It pays to protect your crops with

Cuprosana

In addition to increased crop, dusting prevents debilitation of the bush and thereby maintains its Capital value.

Dusting has been carried out on numerous estates in Ceylon with complete success

CUPROSANA was the pioneer of dusts and will always be the best.

MAINTAINS VITALITY AND INCREASES CROP.

The first and finest dust on the market

UNICROP
AGRICULTURAL CHEMICALS

Sole Agents

HARRISONS & CROSFIELD LTD.

Incorporated in England. Liability of members limited.